



**DEPARTMENT OF THE ARMY**  
Base Realignment and Closure  
Volunteer Army Ammunition Plant  
P.O. Box 22607  
Chattanooga, Tennessee 37422-2607

REPLY TO  
ATTENTION OF:

July 18, 2005

DAIM-BD-A-VO

SUBJECT: Statement of Basis, East Acid Area (Area of Concern #1), Volunteer Army Ammunition Plant, Chattanooga, Tennessee, 18 July 2005

Mr. Timothy R. Woolheater  
Senior Remedial Project Manager  
Environmental Protection Agency  
Federal Facilities Branch  
61 Forsyth Street  
Atlanta, GA 30303

Dear Mr. Woolheater:

A copy of the subject report is submitted for your review and comments. A separate letter has been sent to Ms. Nancy Frazier of TDEC.

The certification required in Section XV, paragraph 4, is also enclosed.

Army Project Coordinator is Mr. Robert Elmore (423-893-6803) and all written communication concerning this report should be directed to him via the Commander's Representative, Mr. Scott Bolton (423-893-5121).

Sincerely,

Scott J. Bolton  
Commander's Representative

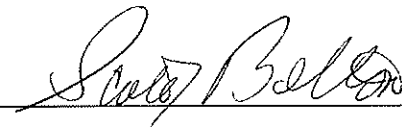
Enclosures

Copies Furnished (w/encls):

Mr. Doug Webb, Corps of Engineers, ATTN: CESAM-EN-GH,  
109 St. Joseph Street, Mobile, AL 36602 (1 CD, 1 Report)  
U.S. Army Environmental Center, ATTN: Mr. Richard O'Donnell,  
E4480 Beal Road, Aberdeen Proving Ground, MD 21010 (1 CD, 1 Report)  
US Army Base Realignment and Closure, DAIM-BD-A (Mr. Ron Blackledge),  
1347 Thorne Avenue, SW Bldg 243, Fort McPherson, GA 30330-1062 (Letter Only)  
US Army Base Realignment and Closure, DAIM-BD-A (Mr. Victor Bonilla),  
1347 Thorne Avenue, SW Bldg 243, Fort McPherson, GA 30330-1062 (Letter Only)  
US Army Base Realignment and Closure, DAIM-BD-A (Ms. Heather Black),  
1347 Thorne Avenue, SW Bldg 243, Fort McPherson, GA 30330-1602 (1 CD, 1 Report)  
Mr. J. E. Bentkowski, PG, Gannett Fleming, Inc., Suite 2750,  
Peachtree Center Tower, 230 Peachtree Street, NW, Atlanta, GA 30303-1512 (1 CD, 1 Report)  
Mr. Mikael Spangberg, Mactec, Inc., 1080 Elm Street,  
Rocky Hill, CT 06067 (1 Report)  
Mr. Mark Gardiner, Shaw E&I, Inc., 312 Directors Drive,  
Knoxville, TN 37923-4799 (1 CD)  
Mr. Frank Bogle, Tetra Tech Inc., Suite A600,  
800 Oak Ridge Turnpike, Oak Ridge, TN 37830 (1 CD, 1 Report)  
Mr. Steve Muffler, Tetra Tech Inc., Suite A600,  
800 Oak Ridge Turnpike, Oak Ridge, TN 37830 (1 Report)  
Mr. Bob Elmore, Volunteer Army Ammunition Plant,  
P.O. Box 22607, Chattanooga, TN 37422-2607 (1 CD, 2 Reports)  
Ms. Nancy Frazier, Sr Remedial Project Mgr, Division of Remediation,  
4th Floor L&C Annex, 401 Church Street, Nashville, TN 37243-1538 (1 CD, 3 Reports)  
Ms. Laura Fabrizio, Regional Counsel, Office of the Staff Judge Advocate  
1777 Hardee Avenue SW, Fort McPherson, GA 30330 (Letter Only)  
Ms. Lori Dennis, GSA, Property Disposal (4PR), 401 West Peachtree St., NW,  
Suite 2528, Atlanta, GA 30308 (Letter Only)  
Ms. Rebecca Browder, Real Property Mgr, Hamilton County Real Estate Div.,  
4th Floor Mayfield Annex, 123 East 7th Street, Chattanooga, TN 37402 (Letter Only)  
Mr. Karl Blankenship, 106 Highland Place,  
Sheffield, AL 35660 (1 CD)  
Ms. Jennifer Stump, Gannett Fleming, Inc. (Eco Risk Documents Only),  
207 Senate Avenue, Camp Hill, PA 17011-2316 (1 Report)

## DOCUMENTATION CERTIFICATION

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to evaluate the information submitted. I certify that to the best of my knowledge and belief the information contained in or accompanying this submittal is true, accurate, and complete. As to those identified portion(s) of this submittal for which I cannot personally verify the accuracy, I certify that this submittal and all attachments were prepared in accordance with procedures designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those directly responsible for gathering the information, or the immediate supervisor of such person(s), the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature: \_\_\_\_\_

Name: Scott J. Bolton

Title: Commander's Representative

Date: July 18, 2005



US Army Corps  
Of Engineers  
Mobile District

**STATEMENT OF BASIS  
EAST ACID AREA  
AREA OF CONCERN #1  
VOLUNTEER ARMY AMMUNITION PLANT  
CHATTANOOGA, TENNESSEE  
18 July 2005**

**PURPOSE OF STATEMENT OF BASIS**

This Statement of Basis has been developed to inform the public and solicit comments on the proposed remedy for cleanup of contamination in soil

**Brief Site Description**

The East Acid Area is located in the north-central part of Volunteer Army Ammunition Plant east of the Old TNT Area. The East Acid Area was constructed in the early 1940s and remained in operation until 1970. Various concentrations of acids for use in the TNT manufacturing process were produced at the site. Production facilities were located within a 17.9-acre area, bounded to the east and west by rail lines and to the north and south by roads. The three main products manufactured at the East Acid Area were weak nitric acid, oleum (sulfuric acid mixed with sulfur trioxide) and mixed acid (strong nitric acid mixed with oleum). Most of the structures have been demolished, however some of the foundations remain.

and sediment at the East Acid Area, Volunteer Army Ammunition Plant (Volunteer). The East Acid Area is shown in Figure 1. The installation restoration program team, consisting of the United States Army, the United States Environmental Protection Agency (EPA) Region 4, and the State of Tennessee Department of Environment and Conservation (TDEC), have determined that the proposed remedy is cost effective and protective of human health and the environment. The Army team includes the United States Army Environmental Center, the United States Army Base Realignment and Closure Division, the United States Army Corps of Engineers, and various environmental consulting firms. Prior to finalization of the proposed remedy, the

installation restoration program team is offering the public an opportunity to comment on the proposed remedy. At any time during the public comment period, comments may be submitted as described in the "How Do You Participate" sec-

tion of this Statement of Basis. Upon closure of the comment period, the installation restoration program team will address all comments and issues raised and determine if there is a need to modify the proposed remedy prior to implementation.

**WHY IS CLEANUP NEEDED?**

The results of the Resource Conservation and Recovery Act (RCRA) Facility Investigation indicated that lead, polychlorinated biphenyls (PCBs), explosives as trinitrotoluene (TNT) and dinitrotoluene (DNT), and arsenic are present at the East Acid Area in soil, and to a lesser degree, in sediment at concentrations that could be potentially harmful to human health.

**HOW DO YOU PARTICIPATE?**

The installation restoration program team solicits public review and comment on this Statement of Basis. This comment period will be conducted prior to finalization of the proposed remedy as a selected remedy. The comment period for this Statement of Basis is from July 18, 2005 to August 16, 2005. If requested during the comment period, the Installation restoration program team will hold a public meeting to respond to any oral comments or questions regarding the proposed remedy. To request a hearing or provide

**The Proposed Cleanup Remedy**

- For soil and sediment above industrial cleanup criteria, excavation of affected soil to a maximum depth of 20 feet, on-site ex situ stabilization of soils containing lead, arsenic, and explosives (TNT and DNT) above hazardous criteria, and offsite disposal of excavated and stabilized soil.
- Land use controls will be implemented to eliminate potential exposure to residual soil contamination to include:
  - Prohibition of residential development.

comments, contact the following persons in writing within the comment period:

Mr. Scott Bolton  
Commander's Representative  
Volunteer Army Ammunition Plant  
P.O. Box 22607  
Chattanooga, Tennessee 37422  
E-mail: [Scott.J.Bolton@us.army.mil](mailto:Scott.J.Bolton@us.army.mil)  
(423) 893-9143

Mr. Timothy R. Woolheater, P.E.  
EPA Federal Facilities Branch  
Waste Management Division  
Sam Nunn Atlanta Federal Center  
61 Forsyth Street  
Atlanta, GA 30303-8960  
E-mail: [woolheater.tim@epamail.epa.gov](mailto:woolheater.tim@epamail.epa.gov)  
(404) 562-8510

Ms. Nancy Frazier  
Tennessee Department of Environment  
and Conservation – Division of Remediation  
4<sup>th</sup> Floor, L & C Annex  
401 Church Street, Nashville, TN 37423  
E-mail: [Nancy.Frazier@state.tn.us](mailto:Nancy.Frazier@state.tn.us)  
(615) 532-0900

The U.S. EPA Final Administrative Order (Docket No. RCRA-02-2001-02), the Statement of Basis, and the associated administrative file including the East Acid Area RCRA Facility Investigation/ Corrective Measures Study Report and subsequent reports will be available to the public for viewing and copying at:

Chattanooga-Hamilton County  
Bicentennial Library  
1001 Broad Street  
Chattanooga, TN 37402

To request further information, you may contact one of the following people (see previous contact information: Mr. Scott Bolton, Mr. Tim Woolheater, or Ms. Nancy Frazier.

### **FACILITY DESCRIPTION**

Volunteer was a government-owned and contractor-operated facility formerly used for the produc-

tion and storage of 2,4,6-TNT. Volunteer was built between 1942 and 1943 to support World War II and was operated subsequently during the Korean and Vietnam conflicts. The facility was placed on standby in 1977 when production ceased and was declared excess by the Army in 1999. Following the declaration, property transfers and sales were initiated. Currently, the Department of the Army is conducting environmental investigations, remediation, and maintenance at the plant. The rail lines at Volunteer have been leased. Under the lease, the rail lines have been refurbished in the East Acid Area and are used by the Chattanooga Railcar Company. Other than the Chattanooga Railcar Company, there are no other tenants or leases currently in place for the East Acid Area.

### **SITE DESCRIPTION AND HISTORY**

The East Acid Area was constructed in the early 1940s to support TNT Batch Process Lines 13 through 16 and was in operation until 1970. The majority of the production facilities have been demolished and removed from the area; however, many of the building foundations are still present. Weak nitric acid (60 percent nitric acid) was produced at the Ammonia Oxidation Plant (Building 302-3). Strong nitric acid (95 to 98 percent nitric acid) was produced at the Nitric Acid Concentrator (Building 303-3). A primary support operation in the East Acid Area was the Sulfuric Acid Concentrator. The Sulfuric Acid Concentrator (Building 308-3) recycled sulfuric acid recovered both from the TNT manufacturing process and the nitric acid concentration process to yield strong sulfuric acid. The strong sulfuric acid was used in the Nitric Acid Concentrator in the production of oleum or shipped offsite.

At the Oleum Plant (Building 307-3), sulfur was melted by steam and passed over a series of baffles to remove dirt before being stored in a lined pit. In turn, sulfur dioxide was oxidized by a vanadium pentoxide catalyst to produce sulfur trioxide which was mixed with sulfuric acid to make oleum.

Three toluene storage tanks are located at the East Acid Area. The tanks stored between 132,000 and 299,100 gallons of toluene. The contents of these tanks were removed in 1977. Two additional storage tanks are located on the hill to the east of the facility. One of the tanks was exclusively used for the storage of fuel oil. The other contained toluene initially and fuel oil later. These tanks were still present in early 2004; the contents were removed in 1977.

Sewer lines routed acid waste from all the acid production and storage areas to the Neutralization Plant (Building 410-2). The Neutralization Plant also contained a tank used for settling and skimming. Effluent from the neutralization process was discharged just west of the East Acid Area into Pond 7, which is connected to Pond 10 via a culvert beneath Sterchi Road. A dam on the west side of Pond 10 controlled discharge of surface water to a drainage ditch that ultimately leads to Waconda Bay. This practice ceased in or around 1977.

Several environmental investigations were conducted at or in the vicinity of the East Acid Area between 1981 and the present. Remedial activities have not been conducted at the site. Previous environmental studies include:

- **1981 Exploratory Sampling.** In 1981, surface water and sediment samples were collected from seven locations in and adjacent to Pond 7 and Pond 10 by MCI Consulting Engineers. The objective of the survey was 1) to assess the level of contamination in the ponds and 2) to determine if contaminants were migrating off the site via surface or subsurface pathways. The surface water and sediment samples were analyzed for explosives, including TNT and DNT, general chemistry parameters, and metals, including arsenic and lead. Selected samples were also analyzed for semivolatile organic compounds and pesticides. Detected analytes in surface water included explosives, semivolatile organic compounds, and metals. Detected analytes in sediment included semivolatile organic compounds and metals. The study was unable to determine if contaminants

in Pond 7 and 10 were migrating to the groundwater and then migrating offsite.

- **1984 Confirmatory Survey.** In 1984, seven sediment samples were collected by Battelle Inc. adjacent from Ponds 7 and Pond 10. Six of the samples were collected from locations previously sampled in 1981. The study had two primary objectives. The first objective was to fill the data gaps that were identified in the 1981 exploratory survey. The second objective was to confirm the findings regarding the nature of contamination and the mechanism of off-site contaminant migration. The sediment samples were analyzed for explosives, including TNT and DNT, and metals, including arsenic and lead. The results were summarized in the East Acid Area RCRA Facility Investigation/Corrective Measures Study Report. It was concluded that the aquifer below the ponds was largely confined by a clayey layer, that a groundwater divide exists within Volunteer, and that groundwater flow mimics the surface drainage.
- **1994 Site Investigation.** In 1994, twenty surface soil samples, five surface water/sediment samples, and three groundwater samples were collected from the East Acid Area. The purpose of the investigation was to fill data gaps identified in previous investigations, conduct a site reconnaissance and a review of site-specific documents. The sampling locations focused upon the major production facilities (the Ammonia Oxidation Plant, the Sulfuric Acid Concentrator, the Oleum Plant, and the Sulfur Pit). The samples were analyzed for explosives, including TNT and DNT, volatile organic compounds, semivolatile organic compounds, pesticides, PCBs, and metals. The surface water samples were also analyzed for ammonia. The installation-wide human health risk assessment identified lead and PCBs as risk drivers for soil at the East Acid Area. The conclusions of the study show that explosives (TNT and DNT), PCBs, and metals (primarily lead and arsenic), were present in concentrations above the chemical screening concentrations in surface soil. Subsurface soils were not

characterized. The groundwater samples contained concentrations of explosives (TNT and DNT) above groundwater guidance criteria.

- **1998-1999 Supplemental Sampling.** Supplemental sampling conducted in 1998 and 1999 focused upon the delineation of impacts identified from the 1994 SI sampling, sampling of subsurface soils, as well as the investigation of tanks, buildings, and waste lines associated with the East Acid process area. A total of 144 surface soil samples, 67 subsurface soil samples, and 10 sediment samples were collected. Analytical parameters included explosives, including TNT and DNT, PCBs, arsenic, and lead. The selection of analytes for each sample was based upon the evaluation of the 1994 SI data. The evaluation for these data was included in the East Acid Area RCRA Facility Investigation/Corrective Measures Study Report.
- **2001 Phase II Site Investigation.** In 2001, Potomac Hudson Engineering, Inc. conducted a Phase I Environmental Site Assessment and a Phase II Site Investigation for the U.S. Army for the railroad network at Volunteer. Three of the 23 areas of concern (AOC) identified in the Phase II Site Investigation are located in the vicinity of the East Acid Area, consisting of AOC-8 (East Acid Area-Manufacturing), AOC-9 (East Acid Area – Aboveground Toluene and Fuel Oil Storage Tanks), and AOC-10 (East Acid Area-Historical Redwater Ash Handling Area). AOC-8 encompasses the East Acid Area production facility that was investigated in 1994 and 1998-1999. AOC-9 encompasses the toluene and fuel oil storage tanks located to the east and southeast of the East Acid Area production facility. AOC-10 is the Redwater Ash Handling Area located to the north of the East Acid Area and is not considered to be part of the East Acid Area.

PHE collected a total of 30 surface soil samples from AOC-8, -9, and -10 for the Phase II site investigation. The samples were collected within 25 feet of the rail line. Most samples

were analyzed for arsenic, lead, and PCBs. Selected samples were analyzed for explosives including TNT and DNT, polynuclear aromatic hydrocarbon compounds, and toluene. Several samples contained arsenic and polynuclear aromatic hydrocarbons above EPA preliminary remedial goals. In January 2004, pre-excavation sampling was conducted in preparation for an interim corrective measure for arsenic contaminated soil at the Redwater Ash Handling Area (AOC-10). None of these samples collected contained arsenic above the preliminary remedial goal, therefore no soil was excavated.

- **2004 RCRA Facility Investigation/ Corrective Measures Study.** The RCRA Facility Investigation indicates the primary contaminants for soil, based upon frequency of detection and concentrations above screening criteria, are lead, PCBs, arsenic, and explosives (TNT and DNT). The lateral distribution of these contaminants encompasses much of the site, however most of the elevated contaminant concentrations are located in the vicinity of the production facilities. Contamination appears to be limited to the top two feet of soil for most of the contaminated area. Sediment in Pond 7 contains elevated lead, and one sample from a location down gradient of the East Acid Area near the TNT Manufacturing Valley site contained concentrations of thallium above acceptable levels (See “Summary of Site Risk” below). The Corrective Measures Study documented the basis and procedures used in identifying, developing, screening, and evaluating remedial alternatives and removal actions which address soil and sediment contamination at the East Acid Area. Remedial measures for surface water are not proposed because surface water is only present for brief periods following heavy rains. Cleanup up of surface water will be achieved by the removal of contaminated soil and sediment that could potentially migrate to surface water.

- **2003---Ongoing Installation-Wide Groundwater RCRA Facility Investigation/ Corrective Measures Study.** As part of the Installation-Wide Groundwater RCRA Facility Investigation/Corrective Measures Study, ten additional groundwater monitoring wells were installed within and adjacent to the East Acid Area to further define the nature and extent of groundwater contamination. Samples were collected from the new and existing wells in 2003 and in the spring and fall of 2004 to evaluate seasonal and temporal trends in groundwater contaminant concentrations. Contaminants detected above preliminary remedial goals and/or maximum contaminant levels include explosives and metals. Initial evaluation of the explosives data suggests that contaminant concentrations are decreasing with time. Groundwater contamination at the East Acid Area is being addressed on an installation-wide basis and is not included in the scope of the soil corrective measures study.

## **SUMMARY OF SITE RISK**

An installation-wide human health and ecological risk assessment was conducted in 1994 and revised in 2002 to estimate the health risks associated with the site contamination. The risk assessment was performed in accordance with risk management decision processes established by the EPA, TDEC, and the U.S. Army Corps of Engineers. The risk evaluation for human health and ecological receptors was updated and summarized in the RCRA Facility Investigation/Corrective Measure Study for the East Acid Area. A summary of the risk assessment for the East Acid Area is as follows:

### **Human Health Risk Assessment**

Chemicals of Concern identified for human health during the HHRA were:

- Sediment: Thallium
- Soil: Explosives TNT and DNT, the PCB Aroclor 1254, lead, and arsenic.

Groundwater at the East Acid Area is being addressed under a Site Wide RFI/CMS.

The PCB Aroclor 1254 was the primary risk driver in soil for the future industrial on-site worker, construction worker, and on-site resident. Lead was also a leading chemical of concern at the East Acid Area. Samples with elevated lead concentrations were widely distributed across the Area. However, the sample where the maximum concentration of lead was detected in 1999 was located in the same area where the highest elevated Aroclor 1254 was encountered. TNT and DNT were detected in soil at concentrations that exceed risk-based criteria, however the concentrations do not constitute an explosives risk.

The East Acid Area sediment and surface water data were evaluated for a drainage basin as a whole, in this case Drainage Basin B at Volunteer. Exposure to sediment from Drainage Basin B resulted in non-cancer hazard estimates for the hypothetical future child resident that exceeded the target hazard index of 1.0. Ingestion of thallium was responsible for nearly the entire hazard. However, the locations where the hazard estimates exceeded one are located several hundred feet to the north of the East Acid Area... Thallium was not a hazard in East Acid Area soils, nor was it found in surface water in Drainage Basin B.

While no volatile organic compounds were identified as chemicals of concern in surface or subsurface soil specifically for the East Acid Area site, elevated concentrations of toluene have been detected in groundwater in the vicinity of the toluene tanks located east of the East Acid Area. Additional investigations will be required to determine the extent of toluene in soil and groundwater in the vicinity of the tanks. Toluene has not been detected at elevated concentrations in soil, sediment, surface water, or groundwater samples collected within the East Acid Area; therefore, toluene was not evaluated in the risk assessment for the site.



## Ecological Risk Assessment

Consistent with the human health risk assessment the ecological risk is based only upon the 1994 data. The risk assessment concluded that less than 1 percent of the surface soil in the East Acid Area may be acutely toxic to earthworms due to 2,4-DNT, although a significant portion of the site may pose a risk of chronic exposure to other sensitive soil invertebrates. Potential risks to the cottontail rabbit and the American woodcock are predicted in food chain models through accumulation of copper, lead, and 2,4-DNT in vegetation and earthworms. The ecological risk assessment concluded that elevated concentrations of lead and PCBs in soil in areas of the East Acid Area pose a potential risk to wildlife. The presence of lead in surface water, likely due to surface drainage from the soil and the drainage system of the East Acid Area, may also have an effect on aquatic organisms if it is transported downstream to more viable aquatic habitats. The assessment also concluded that ecological risk would be reduced to acceptable levels based on the selected cleanup levels for soil.

### **WHAT ARE THE CLEANUP OBJECTIVES AND LEVELS?**

The cleanup objective is to remove contaminated soil at the East Acid Area that exceeds the cleanup levels. The cleanup levels are risk based and are based upon the assumption that future use of the East Acid Area will be limited to industrial use scenarios. The cleanup levels were developed to reduce contaminant levels sufficiently so that the calculated risk to future onsite industrial workers or construction workers was within acceptable levels. The exposure pathways identified for the industrial and construction worker include inhalation, ingestion, and dermal contact to soil, sediment, and surface water. Table 1 lists the contaminants of concern present at the East Acid Area that are addressed as part of the corrective measures study. The first column lists the chemical name, the second column lists the maximum concentration detected at the East Acid Area in either soil or sediment during past investigations,

**Table 1 – Media Cleanup Goals for Soil and Sediment**

Site-Related Chemicals of Concern (contaminants of concern)	Maximum Detected Concentration (mg/kg)	Site-Specific Clean-up Levels (mg/kg)
Lead	50,400	1,200
Total PCBs	1,160	25
TNT	612	57
Total DNT	1,100	2.54
Arsenic	100	27 (See note)

Note: Arsenic is a naturally occurring metal in soil and is present in a wide range of concentrations at Volunteer. A screening level for arsenic of 27 mg/kg has been established, based upon background studies conducted at Volunteer. Contamination is not suspected for arsenic concentrations at or below 27 mg/kg. Arsenic concentrations above the screening level of 27 mg/kg will require independent evaluation of contamination at the time of delineation and confirmation sampling to determine if contamination is suspected. For the purposes of estimating cleanup volumes and selecting the remedy, arsenic concentrations greater than 27 mg/kg were considered to be indicative of contamination.

and the last column presents the clean-up level to be achieved at the site.

### **CLEANUP ALTERNATIVES FOR THE EAST ACID AREA**

Clean-up alternatives are different combinations of plans, technologies, and processes to restrict access, contain, remove, and to treat contamination in order to protect public health and the environment. The cleanup alternatives considered for the soil and sediment source area of contamination at the East Acid Area are summarized below.

**No Action (Alternative 1).** The No-Action alternative is included as a benchmark for the evaluation of other alternatives. Due to the presence of contaminated media above acceptable regulatory levels, the No-Action alternative does not meet corrective measure objectives. Consequently, additional consideration is not given to this alternative. There is no cost associated with this alternative for the treatment of contaminated soil and sediment.

**Excavation and Off-Site Treatment/Disposal (Alternative 2).** This alternative involves the ex-

cavation of contaminated soils/sediment containing lead, PCBs, explosives (TNT and DNT), and arsenic and the subsequent off-site treatment and disposal of excavated soil/sediment. No on-site treatment of contaminated soil/sediment is conducted under this alternative. The proposed approach is to excavate all the areas in which the concentrations of contaminants of concern exceed the cleanup criteria. Much of the excavated material would require disposal as hazardous waste. This alternative would be protective of human health and the environment and comply with regulatory requirements. The complete removal and off-site disposal of contaminated material provides permanent protection of human health and the environment, reduces toxicity, mobility, and volume of contaminated soil and sediment, and is easily implementable. Since this alternative involves the excavation and off-site disposal of soil/sediment, implementation would not require continuous operation, maintenance, or long-term post-construction monitoring. Therefore, this alternative was fully evaluated in the Corrective Measure Study for the site.

**Excavation, On-Site Ex Situ Treatment, and Off-Site Treatment/Disposal (Alternative 3).**

This alternative involves the excavation of contaminated soil/sediment containing lead, PCBs, explosives (TNT and DNT), and arsenic, similar to Alternative 2. Once excavated, the soil containing hazardous levels of lead, arsenic, and explosives (TNT and DNT) is then stabilized on-site to make it nonhazardous, and then is disposed of off-site. Soils containing PCBs below hazardous waste levels will be disposed as nonhazardous waste with the stabilized metals and explosives-contaminated soil. Stabilization is not effective for PCBs, therefore some soils containing PCBs above hazardous waste levels (Toxic Substances Control Act criteria) would require disposal offsite as hazardous waste. This alternative would be protective of human health and the environment and comply with regulatory requirements. The complete removal, on-site ex situ treatment, and off-site disposal of contaminated material provides permanent protection of human health and the environment, reduces toxicity, mobility, and volume of contaminated soil and sediment, and is easily

implementable. Since this alternative involves the excavation, stabilization of metals (lead and arsenic) and explosives (TNT and DNT) contaminated soil, and off-site disposal of soil/sediment, implementation would not require continuous operation, maintenance, or long-term post-construction monitoring. Therefore, this alternative was fully evaluated in the Corrective Measure Study for the site.

**EVALUATION OF REMEDY ALTERNATIVES**

Each cleanup alternative was evaluated to determine how each potential remedy would comply with the four threshold criteria for corrective measures. The four threshold criteria for corrective measures are:

- Overall Protection of Human Health and the Environment
- Attainment of Media Cleanup Standards
- Source Control
- Compliance with Waste Management Standards.

The No Action (Alternative 1) option fails to meet the threshold criteria and was eliminated from consideration. The two remaining cleanup alternatives were evaluated against the five corrective action balancing criteria to determine the preferred final remedy.

The five balancing criteria for corrective measures are:

- Long-term reliability and effectiveness
- Reduction in the toxicity, mobility, or volume of wastes
- Short-term effectiveness
- Implementability
- Cost.

The balancing criteria are used to focus the selection of a remedial alternative on a final remedy that considers practical, technical, and economic factors.

Both Alternative 2 (Excavation and Off-Site Treatment/Disposal) and Alternative 3 (Excavation, On-Site Ex Situ Treatment, and Off-Site Treatment/Disposal) satisfy the first four balancing criteria. Costs for Alternative 3 are 45% lower than the costs for Alternative 2 because the majority of the contaminated soil/sediment will be treated onsite for subsequent off-site disposal in a landfill and will not require disposal as a hazardous waste. Alternative 3 was selected as the preferred alternative. Figure 1 shows the approximate areas that will be excavated. Table 2 contains the comparison analyses of the three alternatives.

### **LAND USE CONTROLS**

The land use plan for the East Acid Area is redevelopment of the property for commercial/industrial use for exposure to an adult worker. Therefore, the cleanup standards for this site are based upon industrial applications, and the remedial plan is to remove or destroy contamination to meet industrial cleanup standards. The remaining residual contamination is inappropriate for unrestricted land use, and land use controls (LUCs) will, therefore, be implemented to preclude unrestricted land use at the site. The objective of the LUCs is to prohibit the development and use of property for residential housing, elementary and secondary schools, child care facilities and playgrounds. LUCs will also preclude access to and/or use of groundwater. The LUC design will be prepared as the LUC component of the site corrective measures implementation (CMI) work plan and submitted in accordance with the Corrective Action Management Plan schedule. The LUC work plan shall address all required implementation and maintenance actions, including periodic inspections, as deemed necessary. Until the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §120(h)(3)(A)(ii)(I) covenant is granted for the East Acid Area, the Army is responsible for implementing, maintaining, reporting on, and enforcing the LUCs. After

the CERCLA covenant is granted, the transferee and its successors will be responsible for periodic site inspection of the LUCs and notification of any deficiencies or violations and will also be responsible for inspection and maintenance for all land use control fences and signs; however, the Army retains ultimate responsibility for remedy integrity. The LUCs will be maintained as needed until the concentrations of hazardous substances in the soil and groundwater are at such levels to allow for unrestricted use and exposure.

Final groundwater restrictions will be placed on this site, as necessary, based on the final remedy for the Site Wide Groundwater Investigation Area (AOC #6).

### **WHAT IMPACTS WOULD THE CLEANUP HAVE ON THE LOCAL COMMUNITY?**

There would be limited impacts to the surrounding communities because the cleanup activities at the East Acid Area will take place on property that has been transferred to the local government while the Army continues to be responsible for the implementation of the remedy. Property to the east and south of the East Acid Area is owned by the local government and is under redevelopment for use as an industrial park. Property to the west is currently undergoing remediation by the Army and is planned for development as industrial property by the local government. Therefore, there is a buffer zone from potential dust and noise caused by excavation activities. However, there will be increased truck traffic on local roadways associated with site remediation. Highway 58 is located to the north of the area.

### **WHY DOES THE INSTALLATION RESTORATION PARTNERING TEAM RECOMMEND THIS REMEDY?**

The installation restoration program team recommends the proposed remedy because it is the most cost effective, easily implemented, and reliable technology available for soil remediation at the East Acid Area. The proposed remedy meets the four general standards for corrective measures and best balances the practical, technical, and eco-

nomic factors that must be considered. Stabilization is not an irreversible process and therefore does not achieve the preference for reduction in volume or toxicity. However, placement of stabilized waste in an engineered disposal cell minimizes the possibility that conditions conducive to leaching will be created.

### **NEXT STEPS**

The Installation restoration program team will review all comments addressing this Statement of Basis to determine if the proposed remedy requires modification prior to implementation. If the proposed remedy is determined to be appropriate for implementation, then the final remedy will be implemented as follows:

- 1) Following approval of the Final Statement of Basis (after the public comment period), the Army shall prepare and submit to EPA and TDEC for review and approval a CMI plan in accordance with the Corrective Action Management Plan schedule. The plan will include a description of the soil remedial activities to be performed as well as the land use control measures to be implemented and land use control maintenance activities, including periodic inspections.
- 2) The corrective measures implementation plan will be implemented.
- 3) After remedial activities have been completed, land use controls will be implemented and maintained to prevent residential land use at the site.

### **GLOSSARY**

**Area of concern (AOC)** – Areas identified during the course of investigation that may have been contaminated by operations at the site.

**Chemicals (contaminants) of Concern** – Chemicals that are present in soil or sediment at the site at levels that are considered harmful to human health or the environment.

**Corrective Measures Study** – A study completed to determine the best available alternative for cleaning up a contaminated site.

**DNT** – Dinitrotoluene, a nitroaromatic explosive compound manufactured in the process of making TNT or found as a by-product of the degradation of TNT.

**Ex-situ** – Latin term meaning “not in place” used in this case to indicate that treatment of soil takes place after the soil has been excavated from the ground.

**Oleum** – Concentrated sulfuric acid mixed with sulfur trioxide and used in the TNT manufacturing process.

**Phase I Environmental Site Assessment/Phase II Site Investigation** – Initial assessment of a site followed by an initial investigation to determine the presence or absence of chemicals of concern.

**Polychlorinated Biphenyls (PCBs)** – A suite of chemicals that were used in dielectric and insulating oils prior to the early 1970s in electrical transformers, pumps and compressors, and fluorescent light fixtures. At the East Acid Area the primary PCB of concern is the chemical Aroclor 1254.

**Polynuclear Aromatic Hydrocarbons** – A suite of chemicals commonly found in asphalt, tar, and other petroleum-based compounds, many of which are cancer-causing or cancer-promoting chemicals.

**Preliminary Remedial Goals** – A conservative set of comparison values determined by EPA against which site data are screened to evaluate the presence of chemicals of potential concern.

The values are based on a one in one million (1/1,000,000) cancer threshold or a non-cancer hazard index target of 1.0 for a potential future resident.

**Resource Conservation and Recovery Act (RCRA) Facility Investigation** – An investigation conducted under the requirements of RCRA to determine the nature and extent of contamination at a site, evaluate the risk of exposure to the contamination for human health and the environment, and estimate the fate and transport of the chemicals in nature.

**Semivolatile Organic Compounds** – A suite of petroleum-based chemicals, which includes the polynuclear aromatic hydrocarbons, many of which are cancer-causing or cancer-promoting chemicals.

**TNT** – Trinitrotoluene, a nitroaromatic explosive compound manufactured at Volunteer.

**Toluene** – A volatile organic compound solvent used in the manufacture of TNT.

**Volatile Organic Compounds** – A suite of chemicals classified by their volatility.

**Table 2**  
**Comparative Analysis of Alternatives**  
**East Acid Area**  
**Volunteer Army Ammunition Plant, Chattanooga, Tennessee**

(Page 1 of 2)

<b>Criteria</b>	<b>Alternative 1: No Action</b>	<b>Alternative 2: Excavation and Off Site Disposal</b>	<b>Alternative 3: Excavation, Ex-Situ Stabilization, and Off Site Disposal</b>
<b>Overall Protectiveness</b>			
Human Health Protection	No reduction in risk.	Reduces the concentration of COCs to levels below CAOs.	Reduces the concentration of COCs to levels below CAOs.
Environmental Protection	No reduction in risk.	Reduces the likelihood of contaminant spread to other media.	Reduces the likelihood of contaminant spread to other media.
<b>Compliance with Regulatory Requirements</b>			
RCRA, TSCA	Permits exposures to soil above CAOs.	Prevents exposures to soil exceeding CAOs.	Prevents exposures to soil exceeding CAOs. TSCA approval may be required.
<b>Long-Term Effectiveness and Permanence</b>			
Magnitude of Residual Risk	Existing risk will remain.	Residual risk will be below the CAOs	Residual risk will be Below the CAOs
Adequacy and Reliability of Controls	No controls over remaining contamination except LUCs. No reliability.	No long-term controls required at site other than LUCs.	No long-term controls required at site other than LUCs.
<b>Reduction of Toxicity, Mobility, or Volume through Treatment</b>			
Treatment Process Used	None	No on-site treatment.	Ex-situ stabilization of COCs with Portland cement.
Amount Destroyed or Treated	None	No on-site treatment.	Vast majority of contaminated soil treated on site.
Irreversible Treatment	None.	No on-site treatment.	Stabilization is not an irreversible process, but placement of stabilized waste in an engineered disposal cell minimizes the possibility that conditions conducive to leaching will be created.
Type of Residuals Remaining after Treatment	Contaminated soil remains.	Contaminated soil above residential land use control levels will remain on site.	Contaminated soil above residential land use control levels will remain on site.
<b>Short-Term Effectiveness</b>			
Community Protection	May present future risk to community.	Normal safeguards would be required during transportation of waste materials offsite.	Normal safeguards would be required during transportation of waste materials offsite.
Worker Protection	No risk to workers	Dust released during excavation and screening may require controls. Risks associated with normal construction activities include slip/trip/fall and equipment operation hazards.	Dust released during excavation, screening, and stabilization may require controls. Risks associated with normal construction activities include slip/trip/fall and equipment operation hazards.

**Table 2**

**Comparative Analysis of Alternatives**  
**East Acid Area**  
**Volunteer Army Ammunition Plant, Chattanooga, Tennessee**

(Page 2 of 2)

<b>Criteria</b>	<b>Alternative 1: No Action</b>	<b>Alternative 2: Excavation and Off Site Disposal</b>	<b>Alternative 3: Excavation, Ex-Situ Stabilization, and Off Site Disposal</b>
Environmental Impacts	Continued impact from existing conditions.	Design of staging piles would require safeguards to prevent migration of contaminants.	Design of staging piles would require safeguards to prevent migration of contaminants. Stormwater run-on/off would require controlling.
Time Until Action is Complete	Not applicable	17 to 21 months	19 to 23 months
<b>Implementability</b>			
Ability to Construct and Operate	No construction or operation.	No significant issues.	Technology well developed and implemented on a full-scale basis at numerous sites.
Ease of Doing More Action if Needed	May require ROD amendment if future problems arise.	Alternative does not preclude additional action.	Stabilized soil that does not meet waste acceptance criteria could be sent offsite to a RCRA hazardous waste TSDF for additional treatment.
Ability to Monitor Effectiveness	No monitoring required.	Effectiveness of stabilization process evaluated through leaching tests.	Effectiveness of stabilization process evaluated through leaching tests.
Ability to Obtain Approvals and Coordinate with Other Agencies	None required.	Approval of disposal facility would be required.	Regulatory approval of stabilized material acceptance testing would be required. Approval of disposal facility would be required.
Availability of Equipment, Specialists, and Materials	None required.	Equipment, technical specialists, and materials readily available	Equipment, technical specialists, and materials readily available
Availability of Technologies	None required	Available	Available
<b>Cost</b>			
Capital Cost	None	\$8,100,000	\$4,400,000
Present Value of Annual Cost	None	\$1,100,000	\$1,100,000
Total Present Value Cost	None	\$9,200,000	\$5,500,000

CAO - Corrective action objective.  
O&M - Operation and maintenance.  
PCB - Polychlorinated biphenyl.  
RCRA - Resource Conservation and Recovery Act.  
ROD - Record of decision.  
TSCA - Toxic Substance Control Act.  
TSDF - Treatment, storage, and disposal facility.



